

Appl. No. 10/063,826
Docket No. 122261/QEM-0003

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (currently amended) A method for decreasing gradient field pulse sequence duration and reducing peripheral nerve stimulation with known gradient pulse areas for a magnetic resonance imaging system, the method comprising:

receiving a first desired area corresponding to a first pulse;

obtaining a second desired area corresponding to a second pulse;

selecting said first pulse as a nested pulse if said first desired area is smaller than said second desired area, and establishing said second pulse as a nesting pulse, otherwise selecting said second pulse as said nested pulse and establishing said first pulse as said nesting pulse, said nested pulse having portions coincident with said nesting pulse;

determining an amplitude and pulse duration for said nested pulse;

ascertaining an amplitude and pulse duration for said nesting pulse; and

arranging a plurality of gradient field pulse sequences to include said nested pulse and said nesting pulse.

2. (currently amended) The method of Claim 1 wherein said determining further comprises:

establishing if said nested pulse is triangular or trapezoidal and establishing a flat top time for said nested pulse if it is trapezoidal; and

calculating ~~said amplitude~~ a ramp time for said nested pulse.

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3. (currently amended) The method of Claim ~~[[1]]~~ 2 wherein said calculating comprises:

setting a first duration corresponding to said nested pulse equivalent to about a second duration corresponding to a flattop portion of said nesting pulse; and

calculating ~~said amplitude~~ a ramp time for said nesting pulse.

4. (original) The method of Claim 1 wherein said first pulse is a slice select rephaser pulse and said second pulse is a readout prephaser pulse.

5. (original) The method of Claim 1 wherein said first pulse is a readout prephaser pulse and said second pulse is a slice select rephaser pulse.

6. (original) The method of Claim 1 wherein said plurality of gradient field pulse sequences includes a slice select pulse sequence, a phase encoding pulse sequence and a readout pulse sequence.

7. (original) The method of Claim 6 wherein: said slice select pulse sequence comprises a slice select pulse, a slice select rephaser pulse and a slice select dephaser pulse; said phase encoding pulse sequence includes a phase encoding pulse and a phase encoding rewinder pulse; and said readout pulse sequence includes a readout prephaser pulse, a readout pulse and a readout dephaser pulse.

8. (original) The method of Claim 7 wherein said slice select dephaser pulse is configured to be about equivalent to said slice select rephaser pulse.

9. (original) The method of Claim 7 wherein said phase encoding rewinder pulse is configured to be about equivalent to said phase encoding pulse but of opposite sign.

10. (original) The method of Claim 7 wherein said readout dephaser pulse is configured to be about equivalent to said readout prephaser pulse.

11. (original) The method of Claim 1 further including determining an amplitude and duration for a slice select pulse and a readout pulse responsive to a desired area for said slice select pulse and another desired area for said readout pulse.

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12. (original) The method of Claim 11 wherein said arranging includes configuring said plurality of gradient field pulse sequences to reduce a gradient field pulse sequence duration and maintain established magnetic field constraints.

13. (original) The method of Claim 1 further including a third desired area corresponding to a third pulse, wherein said plurality of gradient field pulse sequences includes an initial slew of said third pulse which occurs during a non-slewing portion of said nested pulse.

14. (original) The method of Claim 13 further including computing an amplitude and duration of said third pulse responsive to said third desired area.

15. (currently amended) The method of Claim 14 wherein said computing comprises:

establishing if said third pulse is triangular or trapezoidal and establishing a flat top time for said third pulse if it is trapezoidal; and

calculating ~~said amplitude~~ a ramp time for said third pulse.

16. (original) The method of Claim 13 said third pulse is a phase encoding pulse.

17. (currently amended) A system control for decreasing gradient field pulse sequence duration and reducing peripheral nerve stimulation with known gradient pulse areas in a magnetic resonance imaging system, the system control configured to implement a method comprising:

~~a magnetic resonance imaging system including system control configured to implement a method comprising:~~

receiving a first desired area corresponding to a first pulse;

obtaining a second desired area corresponding to a second pulse;

selecting said first pulse as a nested pulse if said first desired area is smaller than said second desired area, and establishing said second pulse as a nesting pulse, otherwise

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selecting said second pulse as said nested pulse and establishing said first pulse as said nesting pulse, said nested pulse having portions coincident with said nesting pulse;

determining an amplitude and pulse duration for said nested pulse;

ascertaining an amplitude and pulse duration for said nesting pulse; and

arranging a plurality of gradient field pulse sequences to include said nested pulse and said nesting pulse.

18. (currently amended) The system control of Claim 17 wherein said determining further comprises:

establishing if said nested pulse is triangular or trapezoidal and establishing a flat top time for said nested pulse if it is trapezoidal; and

calculating ~~said amplitude~~ a ramp time for said nested pulse.

19. (currently amended) The system control of Claim 17 wherein said calculating comprises:

setting a first duration corresponding to said nested pulse equivalent to about a second duration corresponding to a flattop portion of said nesting pulse; and

calculating ~~said amplitude~~ a ramp time for said nesting pulse.

20. (currently amended) The system control of Claim 17 wherein said first pulse is a slice select rephaser pulse and said second pulse is a readout prephaser pulse.

21. (currently amended) The system control of Claim 17 wherein said first pulse is a readout prephaser pulse and said second pulse is a slice select rephaser pulse.

22. (currently amended) The system control of Claim 17 wherein said plurality of gradient field pulse sequences includes a slice select pulse sequence, a phase encoding pulse sequence and a readout pulse sequence.

23. (currently amended) The system control of Claim 22 wherein: said slice select pulse sequence comprises a slice select pulse, a slice select rephaser pulse and a slice select dephaser pulse; said phase encoding pulse sequence includes a phase

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encoding pulse and a phase encoding rewinder pulse; and said readout pulse sequence includes a readout prephaser pulse, a readout pulse and a readout dephaser pulse.

24. (currently amended) The ~~method~~ system control of Claim 23 wherein said slice select dephaser pulse is configured to be about equivalent to said slice select rephaser pulse.

25. (currently amended) The ~~method~~ system control of Claim 23 wherein said phase encoding rewinder pulse is configured to be about equivalent to said phase encoding pulse but of opposite sign.

26. (currently amended) The system control of Claim 23 wherein said readout dephaser pulse is configured to be about equivalent to said readout prephaser pulse.

27. (currently amended) The system control of Claim 17 further including determining an amplitude and duration for a slice select pulse and a readout pulse responsive to a desired area for said slice select pulse and another desired area for said readout pulse.

28. (currently amended) The system control of Claim 27 wherein said arranging includes configuring said plurality of gradient field pulse sequences to reduce a gradient field pulse sequence duration and maintain established magnetic field constraints.

29. (currently amended) The system control of Claim 17 further including a third desired area corresponding to a third pulse, wherein said plurality of gradient field pulse sequences includes an initial slew of said third pulse which is occurs during a non-slewing portion of said nested pulse.

30. (currently amended) The system control of Claim 29 further including computing an amplitude and duration of said third pulse responsive to said third desired area.

31. (currently amended) The system control of Claim 30 wherein said computing comprises:

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establishing if said third pulse is triangular or trapezoidal and establishing a flat top time for said third pulse if it is trapezoidal; and

calculating ~~said amplitude~~ a ramp time for said third pulse.

32. (currently amended) The system control of Claim 29 said third pulse is a phase encoding pulse.

33. (currently amended) A storage medium encoded with a machine-readable computer program code;

said code including instructions for causing a computer to implement a method for decreasing gradient field pulse sequence duration and reducing peripheral nerve stimulation with known gradient pulse areas for a magnetic resonance imaging system, the method comprising:

receiving a first desired area corresponding to a first pulse;

obtaining a second desired area corresponding to a second pulse;

selecting said first pulse as a nested pulse if said first desired area is smaller than said second desired area, and establishing said second pulse as a nesting pulse, otherwise selecting said second pulse as said nested pulse and establishing said first pulse as said nesting pulse, said nested pulse having portions coincident with said nesting pulse;

determining an amplitude and pulse duration for said nested pulse;

ascertaining an amplitude and pulse duration for said nesting pulse; and

arranging a plurality of gradient field pulse sequences to include said nested pulse and said nesting pulse.

34. (canceled)

35. (currently amended) ~~A means~~ An apparatus for decreasing gradient field pulse sequence duration and reducing peripheral nerve stimulation with known gradient pulse areas for a magnetic resonance imaging system, the ~~method~~ apparatus comprising:

~~a means~~ for receiving a first desired area corresponding to a first pulse;

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a-means for obtaining a second desired area corresponding to a second pulse;

a-means for selecting said first pulse as a nested pulse if said first desired area is smaller than said second desired area, and establishing said second pulse as a nesting pulse, otherwise selecting said second pulse as said nested pulse and establishing said first pulse as said nesting pulse, said nested pulse having portions coincident with said nesting pulse;

a-means for determining an amplitude and pulse duration for said nested pulse;

a-means for ascertaining an amplitude and pulse duration for said nesting pulse;

and

a-means for arranging a plurality of gradient field pulse sequences to include said nested pulse and said nesting pulse.

36. (currently amended) A method for nesting gradient pulses in gradient field pulse sequences with known gradient pulse areas for a magnetic resonance imaging system, comprising:

receiving a slice select rephaser pulse desired area indicative of a desired area for a slice select rephaser pulse;

receiving a readout prephaser pulse desired area indicative of a desired area for a readout prephaser pulse;

selecting said slice select rephaser pulse as a nested pulse if said slice select rephaser pulse desired area is smaller than said readout prephaser pulse desired area, and establishing said readout prephaser pulse as a nesting pulse, otherwise selecting said readout prephaser pulse as said nested pulse and establishing said slice select rephaser pulse as said nesting pulse, said nested pulse having portions coincident with said nesting pulse;

determining an amplitude and pulse duration for said nested pulse;

determining an amplitude and pulse duration for said nesting pulse; and

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arranging a plurality of gradient field pulse sequences to include said nested pulse and said nesting pulse in a manner that minimizes concurrent slews of any gradient field.